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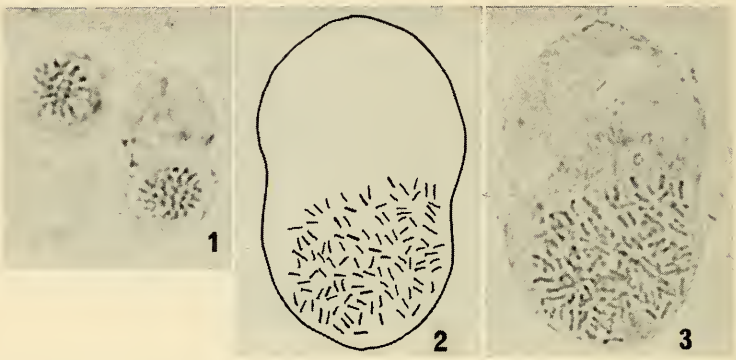
A NEW MARINE DINOFLAGELLATE GENUS, *CACHONINA*, IN AXENIC CULTURE FROM THE SALTON SEA, CALIFORNIA WITH REMARKS ON THE GENUS *PERIDINIUM*

By Alfred R. Loeblich, III

Scripps Institution of Oceanography
University of California at San Diego
La Jolla, California 92037

An armored, photosynthetic dinoflagellate was collected from a bloom in the Salton Sea, California (March 1966) by W. F. Blankley. The species was isolated by means of a Pasteur pipette into axenic culture and was generously placed at my disposal for study. A clone was made from the axenic culture and was the subject of all following observations. Since isolation the culture has been maintained axenically in an enriched sea water medium diluted to 75 per cent with glass distilled water. The following enrichments were used per liter of solution: KNO_3 0.20 g, $K_2HPO_4 \cdot 3H_20$ 0.046 g, soil extract 15 mls (the solution of 1 part soil to 1 part distilled water by weight is autoclaved and the supernatant used), P II metals (Provasoli, 1964) 30 mls, vitamin B_{12} 1 μg, thiamin hydrochloride 1 mg, and biotin 2 μg. The clone is maintained in a north window at room temperature (22–25°C).

Because the tabulation of this species differs from all previously described forms, a new genus and species is here proposed. A culture of this alga (my strain no. 87; Blankley's original culture) has been deposited at the Culture Collection of Algae, Indiana University, Bloomington, Indiana, and has been given the accession number IU No. 1564.



Figs. 1–3. *Cachonina niei* gen. et sp. nov. 1, Acetocarmine stained cells showing the posterior position of the nucleus, the left one in end view, the right in lateral view. Approx. X1200. 2 and 3, Chromosome squash, drawing and photomicrograph at the same magnification as Fig. 1.

Division PYRRHOPHYTA Pascher, 1914
Order Peridiniales Haeckel, 1894
Family Peridiniaceae Diesing, 1850
Cachonina niei gen. et sp. nov.

Cellular morphology: The cell consists of a theca with a pellicle underneath. The pellicle at times can be seen detached from the theca in the apical and cingular regions. This pellicle is present in addition to a cytoplasmic membrane. All measurements have been made on iodine (Lugol's solution) fixed cells. The elongate, dorsal-ventrally flattened cell has an average longitudinal dimension of 18 μ (range 17–20 μ), an average lateral dimension of 11.5 μ (range 11–12 μ), and an average ratio of length to width of 1.61 (range 1.53–1.71). The spherical nucleus, which is 6 μ in diameter, remains posterior to the cingulum (Fig. 1). From acetocarmine stained nuclei two chromosome counts of 111, 112 were obtained (Figs. 2, 3); the chromosomes are short rods of uniform size. Transversely and longitudinally directed flagella are present.

The numerous yellow-brown plastids are parietally arranged. No stigma is present, although stationary phase cells develop several parietal orange colored bodies that presumably are degenerate plastids. The cytoplasm of cells grown in high light intensity contains numerous "starch" grains. No bioluminescence occurs.

Thecal morphology: The cell wall of *Cachonina niei* is very thin, and has poorly marked sutures. In order to determine the tabulation, material was fixed and stained with Lugol's solution (I_2, KI); the wall was stained brown and the sutures were revealed. Cells of this species may undergo

ecdysis, thus leaving behind an empty theca. When stained with iodine, these empty thecae were exceedingly useful for determination of the plate pattern. The cell leaves the theca through the anterior intercalary region and consequently, entire epithecae rarely were found. It is this same anterior dorsal region in peridinoid cysts through which excystment occurs (Evitt, 1967). Although the arrangement of the plates in the epitheca was difficult to determine, a few free, intact epithecae were observed that did reveal clearly the tabulation. In these free epithecae the cingulum was never attached, indicating that the sutures between the epitheca and cingulum are weaker than those between the cingulum and the hypotheca. Figs. 4–7 show the arrangement of the thecal plates.

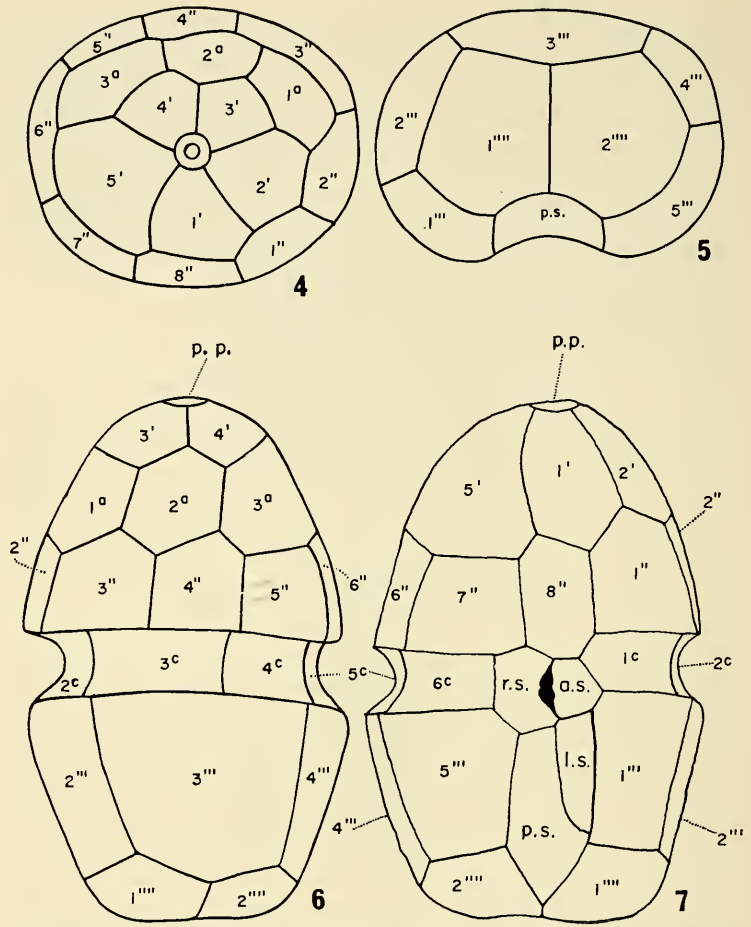
Plate 1′ is in contact only with 8″ and 1″ of the precingular series giving an *ortho* arrangement (Fig. 4). Plate 2a contacts only plates 3″ and 4″ of the precingular series, thus having a *penta* arrangement. In contrast to members of *Peridinium* there is one extra plate in both the apical series and the precingular series in *Cachonina niei*. The six plates of the cingulum are all of approximately equal size. Of the four sulcal plates, the posterior plate is largest. The left sulcal plate is narrow; there is a small anterior plate above the left sulcal plate. The right sulcal plate extends into the cingulum. Between the anterior and right sulcal plates there is a ridged suture through which the flagella penetrate the theca. The hypotheca has the normal arrangement for the Peridiniaceae. The plate tabulation is: pore plate, 5′, 3a, 8″, 6c, a.s., r.s., l.s., p.s., 5‴, 2⁗.

Latin diagnosis: Cellula dorsali-ventraliter applanata, cingulum sinistraliter descendens, per dimidium latitudinis dispositum, sine collaribus. Cornue et ornatus superficiales nulla. Cellula 18 μ long., 11.5 μ lat.; ratio longitudinis et latitudinis 1.61. Plastides parietales multae. Nucleus post cingulum; numerous chromosomatum 112. Theca tenuis. Suturae non valde manifestae. Tabulatio thecalis: lamella pori apicalis, 5′, 3a, 8″, 6c, a.s., r.s., l.s., p.s., 5‴, 2⁗. Habitatio: marina; cellulae in loco Salton Sea, California dicto repertae.

Typus: Cachonina niei sp. nov.
Holotypus: Fig. 7.

Discussion: The two antapical and five postcingular plates of the hypotheca place this organism in the family Peridiniaceae. *Cachonina niei* has an *ortho, penta* arrangement on the epitheca similar to that of members of the section *Tabulata* Jörgensen, 1912, of the genus *Peridinium* Ehrenberg, 1830. The present form differs from species of *Peridinium* in having five apical plates and eight precingular plates, as opposed to four apical plates and seven precingular plates in *Peridinium*.

Much emphasis has been placed on the arrangement of the sulcal plates and the number of cingular plates by Abé (1936) and Balech (1959, 1963), but this information is lacking for the type species of the genus *Peridinium*: *P. cinctum* (Müller) Ehrenberg, 1830, a freshwater species. However, other freshwater species related to *P. cinctum*



Figs. 4–7. *Cachonina niei* gen. et sp. nov. 4, Apical view of the tabulation. 5, Posterior view of the tabulation. 6, Dorsal view of the tabulation. 7, Holotype, ventral view of the tabulation. Plate explanation: *p.p.*, pore plate; *1′–5′*, apical plates; *1a–3a*, anterior intercalary plates; *1″–8″*, precingular plates; *1c–6c*, cingular plates; *a.s.*, anterior sulcal plate; *p.s.*, posterior sulcal plate; *r.s.*, right sulcal plate; *l.s.*, left sulcal plate; *1‴–5‴*, postcingular plates, *1⁗*, *2⁗*, antapical plates.

possess five cingular plates and lack an apical pore. All marine species referred to the genus *Peridinium* that have been examined have only three cingular plates plus a transitional plate, but do possess an apical pore. Thus it appears that the genus *Peridinium* should be divided into

two genera: (a) *Peridinium*, consisting of freshwater species resembling the type species *P. cinctum* and (b) the marine species.

The marine species previously assigned to *Peridinium* whose tabulation has been investigated logically belong to a genus whose type species possesses an apical pore, three cingular plates and a transitional plate. Among the genera considered to be synonymous with *Peridinium*, the genus *Archaeperidinium* Jörgensen, 1912, is the earliest described whose type species has the above three characters. *Archaeperidinium minutum* (Kofoid) Jörgensen, 1912, is the type species of *Archaeperidinium;* Balech (1964) has given a detailed analysis of the thecal plates of this species. The type of *Archaeperidinium* has previously been placed in the section *Tabulata* Jörgensen, 1912, of the genus *Peridinium*. The genus *Peridinium* should be restricted to those non-pored species having the same cingular tabulation as the type species of *Peridinium*. *Archaeperidinium* is therefore the logical and nomenclaturally correct genus for the marine, pored species with three cingular plates and a transitional plate previously placed in *Peridinium*.

Scrippsiella Balech *ex* Loeblich, 1965 (Balech, 1959), has been established for marine, apical pored species with six cingular plates but with otherwise normal *Peridinium* epitheca and hypotheca. *Cachonina* has six cingular plates in common with *Scrippsiella* but has a different number of precingular and apical plates. *Cachonina* differs from the marine *Peridinium* species (now referable to *Archaeperidinium*) in the possession of six cingular plates, but resembles it in the possession of an apical pore. *Archaeperidinium*, *Peridinium*, and *Scrippsiella* all have seven precingular and four apical plates, while *Cachonina* has eight precingular and five apical plates.

Etymology: The generic and specific names are patronymics in honor of Drs. Jean Cachon and Dashu Nie who have contributed greatly to our knowledge of marine dinoflagellates. The gender is feminine.

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